WHAT WE CLAIM IS:

1. An optical system comprising:

a light source;

a light-branching member having a boundary surface for branching light from said light source into a reference light path and a signal light path;

a scanning system for moving light from said light source and a sample relative to each other;

a light-combining member having a boundary surface for combining together said reference light path and said signal light path;

a light-detecting element for detecting light combined by said light-combining member; and

a beam diameter changing optical system placed between said light-branching member and an objective.

2. An optical system according to claim 1. wherein said beam diameter changing optical system is a pupil relay optical system for relaying a pupil of said objective.

3. An optical system comprising:

a light source;

a light-branching member having a boundary surface for branching light from said light source into a reference light path and a signal light path;

a pupil relay optical system placed in said signal light path to relay a pupil of an objective;

a light-scanning system placed in said signal light path in a vicinity of a conjugate position of the pupil relayed by said pupil relay optical system;

a correcting mechanism for making the position of said relayed pupil and said light-scanning system approximately coincident with each other;

a light-combining member having a boundary surface for combining together said reference light path and said signal light path; and

a light-detecting element for detecting light combined by said light-combining member.

4. An optical system according to claim 3, further comprising:

an optical path length control mechanism placed in at least either one of said reference light path and said signal light path to vary an optical path length.

5. An optical apparatus comprising:

a light source;

a light-branching member having a boundary surface for branching light from said light source into a reference light path and a signal light path;

at least one objective placed in said signal light path;

a scanning system for moving light collected by said objective and a sample relative to each other;

a light-combining member having a boundary surface for combining together said reference light path and said signal light path;

a light-detecting element for detecting light combined by said light-combining member;

an optical path length control mechanism placed between said light-branching member and said light-combining member to vary an optical path length; and

a scanning control mechanism;

wherein said scanning system has, at least, a first scanning mechanism for moving said collected light and said sample relative to each other in a first direction parallel to an optical axis of said objective, and a second scanning mechanism for moving said collected light and said sample relative to each other in a second direction perpendicular to said first direction; and

wherein said scanning control mechanism has a function of choosing between said first scanning mechanism and said optical path length control mechanism, and a function of determining a scanning speed of the chosen mechanism and a scanning speed of said second scanning mechanism.

6. An optical apparatus according to claim 5, which has at least one objective capable of being placed in said signal light path and having a numerical aperture that satisfies a condition of $Lc \geqq Df$, where Df is a value generally known as depth of focus, which is obtained from $Df=\lambda c/(NA)^2$, where NA is a numerical aperture of the objective, and λc is a center wavelength of the light source, and Lc is a coherence length of light incident on the sample.

7. An optical apparatus according to claim 5 or 6, has at least one objective capable of being placed in said signal light path and having a numerical aperture that satisfies a condition of $Lc<Df$, where Df is a value generally known as depth of focus, which is obtained from $Df=\lambda c/(NA)^2$, where NA is a numerical aperture of the objective, and λc is a center wavelength of the light source, and Lc is a coherence length of light incident on the sample.

8. An optical apparatus according to claim 7, wherein said scanning control mechanism selectively changes choice between said first scanning mechanism and said optical path length control mechanism and determination of the scanning speed of said chosen mechanism and the scanning speed of said second scanning mechanism in accordance with switching between said objectives.

9. An optical apparatus according to claim 8, wherein said scanning control mechanism sets said scanning speeds as follows:

when $Lc<Df$, $v1>v2$;

when $Lc\geqq Df$, $v2>v1$;

where Df is a value obtained from $Df=\lambda c/(NA)^2$, where NA is a numerical aperture of an objective placed in the signal light path, and λc is a center wavelength of the light source; Lc is a coherence length of light incident on the sample; and v1 and v2 are a scanning speed in the first direction and a scanning speed in the second

direction, respectively.

10. An optical apparatus according to claim 6, wherein said scanning control mechanism sets said scanning speeds as follows:

when $Lc<Df'$, $v1>v2$;

when $Lc \geqq Df'$, $v2>v1$;

where Df' is a value obtained from $Df'=\lambda c/(NA')^2$, where NA' is an effective numerical aperture of an objective placed in the signal light path, and λc is a center wavelength of the light source; Lc is a coherence length of light incident on the sample; and v1 and v2 are a scanning speed in the first direction and a scanning speed in the second direction, respectively.

11. An optical apparatus according to claim 8, further comprising:

a frequency modulating member provided in at least either one of said reference light path and said signal light path, said frequency modulating member having a function of modulating a frequency of light without causing a change in optical path length;

wherein said scanning control mechanism sets said scanning speeds so that the following condition is satisfied regardless of a size relation between Lc and Df or between Lc and Df':

$v2>v1$

where Df and Df' are values generally known as depth of focus, Df being obtained from $Df=\lambda c/(NA)^2$, where NA is a numerical aperture of an objective, λc is a center

wavelength of the light source, Df' being obtained from $Df'=\lambda c/(NA')^2$, where NA' is an effective numerical aperture of an objective, and λc is a center wavelength of the light source; Lc is a coherence length of light incident on the sample; and $v1$ and $v2$ are a scanning speed in the first direction and a scanning speed in the second direction, respectively.

12. An optical apparatus according to claim 8, wherein said scanning system has a third scanning mechanism for moving said collected light and said sample relative to each other in a direction perpendicular to both said first direction and said second direction, and said scanning control mechanism sets scanning speeds as follows:

when $Lc<Df$, $v1>v2>v3$;

when $Lc\geqq Df$, $v2>v3>v1$;

where Df is a value obtained from $Df=\lambda c/(NA)^2$, where NA is a numerical aperture of an objective placed in the signal light path, and λc is a center wavelength of the light source; Lc is a coherence length of light incident on the sample; and $v1$, $v2$ and $v3$ are a scanning speed in the first direction, a scanning speed in the second direction and a scanning speed in the third direction, respectively.

13. An optical apparatus according to claim 6, wherein said scanning system has a third scanning mechanism for moving said collected light and said sample relative to each other in a direction perpendicular to

both said first direction and said second direction, and said scanning control mechanism sets scanning speeds as follows:

when Lc<Df′, v1>v2>v3;

when Lc≧Df′, v2>v3>v1;

where Df′ is a value obtained from $Df' = \lambda c/(NA')^2$, where NA is an effective numerical aperture of an objective placed in the signal light path, and λc is a center wavelength of the light source; Lc is a coherence length of light incident on the sample; and v1, v2 and v3 are a scanning speed in the first direction, a scanning speed in the second direction and a scanning speed in the third direction, respectively.

14. An optical apparatus according to claim 8, wherein said scanning system has a third scanning mechanism for moving said collected light and said sample relative to each other in a direction perpendicular to both said first direction and said second direction;

said optical apparatus further comprising:

a frequency modulating member provided in at least either one of said reference light path and said signal light path, said frequency modulating member having a function of modulating a frequency of light without causing a change in optical path length;

15. An optical apparatus according to claim 14, wherein said scanning control mechanism sets scanning speeds in accordance with a numerical aperture or effective numerical aperture of an objective to be used,

as follows:

when $Lc<Df$ or $Lc<Df'$, $v2>v1>v3$ or $v2>v3>v1$;

when $Lc \geqq Df$ or $Lc \geqq Df'$, $v2>v3>v1$;

where Df is a value obtained from $Df=\lambda c/(NA)^2$, where NA is a numerical aperture of an objective placed in the signal light path, and λc is a center wavelength of the light source; Df' is a value obtained from $Df'=\lambda c/(NA')^2$, where NA' is an effective numerical aperture of an objective placed in the signal light path, and λc is a center wavelength of the light source; Lc is a coherence length of light incident on the sample; and v1, v2 and v3 are a scanning speed in the first direction, a scanning speed in the second direction, and a scanning speed in the third direction, respectively.

16. An optical system or optical apparatus according to claim 6, further comprising:

a dispersion adjusting element for compensating for a difference in dispersion characteristics between said signal light path and said reference light path produced by a change in an effective numerical aperture of said objective and a change in the optical system incidental to said change, said dispersion adjusting element being capable of selectively or continuously controlling an amount of dispersion adjustment made by it.

17. An optical system or optical apparatus according to claim 6, wherein a change in optical path length due to a change in an effective numerical aperture of said objective and a change in the optical system incidental to

said change is compensated by said optical path length control mechanism as an amount of optical path length adjustment made by said optical path length control mechanism.

18. An optical system or optical apparatus according to claim 2, further comprising:

a dispersion adjusting element for compensating for a difference in dispersion characteristics between said signal light path and said reference light path produced by a change in an effective numerical aperture of said objective and a change in the optical system incidental to said change, said dispersion adjusting element being capable of selectively or continuously controlling an amount of dispersion adjustment made by it.

19. An optical system or optical apparatus according to claim 4, wherein a change in optical path length due to a change in an effective numerical aperture of said objective and a change in the optical system incidental to said change is compensated by said optical path length control mechanism as an amount of optical path length adjustment made by said optical path length control mechanism.

20. An optical system or optical apparatus according to claim 18, wherein a change in optical path length due to a change in an effective numerical aperture of said objective and a change in the optical system incidental to said change is compensated by said optical path length control mechanism as an amount of optical path length

adjustment made by said optical path length control mechanism.